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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/583,976	09/19/2006	Yeong Su Song	4913-0001	8433
27123 7590 07/21/2008 MORGAN & FINNEGAN, L.L.P. 3 WORLD FINANCIAL CENTER NEW YORK, NY 10281-2101				
EXAMINER				
VINIL LAN				
ART UNIT		PAPER NUMBER		
1792				
NOTIFICATION DATE		DELIVERY MODE		
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary

Application No.

10/583,976

Applicant(s)

SONG ET AL.

Examiner

LAN VINH

Art Unit

1792

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 September 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 14-23 is/are allowed.
- 6) ☒ Claim(s) 1-13 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/CDC)
- Paper No(s)/Mail Date 091906

- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 4-5 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 4-5 recite the limitations "the spacing" and " the sectional area". There is insufficient antecedent basis for these limitations in the claims.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 7-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Johnson et al (US 2003/0006019) in view of Okumura et al (US 5,888,413)

.Johnson discloses a process for plasma etching and depositing in a plasma chamber. The process comprises:

preparing a plurality of plasma source coils including a first plasma source coil 16, a second plasma source coil 18, and a third plasma source coil 20, coils 16, 18, 20 have different heights, and different diameters (para 0019, 0021, 0025)

having an etching rate at the center part thereof higher than that of the first plasma source coil having an etching rate at the edge part thereof higher than that of the first plasma source having an etching rate at the center part thereof higher than that of the first plasma source coil having an etching rate at the edge part thereof higher than that of the first plasma source

disposing the first plasma source coil 16 on the plasma chamber and etching a wafer 6/test wafer (para 0018; fig. 1)

analyzing the etching rate for each position of the test wafer to increase the RF power delivered to coil 16 or 20 (para 0040), which reads on analyzing the etching rate for each position of the test wafer and replacing first plasma source coil with the third plasma source coil based on the analysis results.

Unlike the instant claimed invention as per claim 1, Johnson fails to specifically disclose that the second plasma source coil having an etching rate at the center part thereof higher than that of the first plasma source coil and the third plasma source coil having an etching rate at the edge part thereof higher than that of the first plasma source

Okumura, in a plasma processing method, discloses that the etching rate of a plasma coil source vary from the center to the edge of the coil depending on the shape of the coils (col 7, lines 51-57; figs 9-10, col 8, lines 25-40)

Since Johnson discloses that the coils can have different form/shape (para 0032), one skilled in the art at the time the invention was made would have found it obvious to have modified Johnson's second plasma source coil 18 to have an etching rate at the

center part thereof higher than that of the first plasma source coil 16 and the third plasma source coil 20 to have an etching rate at the edge part thereof higher than that of the first plasma source coil in view of Okumura teaching in order to achieve uniform in-plane distribution of the etching rate and uniform plasma density in the chamber

The languages of "if it is determined that the etching rate at the center part of the test wafer is higher than that at the edge part of the test wafer based on analysis results of the etching rate for each position of the test wafer" and "if it is determined that the etching rate at the edge part of the test wafer is higher than that at the center part of the test wafer based on analysis results of the etching rate for each position of the test wafer", as recited in claims 7, 8, are language that render the claimed steps of "the first plasma source coil is replaced with the third plasma source coil and then a main etching process is performed using the third plasma source coil" and "the first plasma source coil is replaced with the second plasma source coil and then a main etching process is performed using the second plasma source coil" the optional limitations. Since the limitations are optional, they can be used to distinguish the claims over the prior art of record

3. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Johnson et al (US 2003/0006019) in view of Okumura et al (US 5,888,413) and further in view of Pu et al (2003/0192644)

Johnson as modified by Okumura has been described above. Unlike the claimed invention as per claim 2, Johnson and Okumura fails to disclose that each of the plasma

source coils comprises: a coil bushing disposed in the center thereof; and a plurality of unit coils helically wound on the coil bushing while one end of each of the unit coils is fixed to the coil bushing, the number of the unit coils being m , where m is a positive number of two or more, each of the unit coils having a predetermined number of turns (n) expressed by the following equation: $n = a \times (b/m)$, where a and b are positive numbers, respectively.

Pu, in a method for inductively coupling power to a plasma chamber, discloses using plasma source coils comprises: a coil bushing disposed in the center thereof; and a plurality of unit coils (3) helically wound on the coil bushing while one end of each of the unit coils is fixed to the coil bushing, the coil has $3^{3/4}$ turn of wire/ (n) (para 0103,0105, fig. 1)

Since Johnson discloses that the coil can be multi-turn coils (para 0032), one skilled in the art at the time the invention was made would have found it obvious to calculate the number of turn in Johnson coils by employing the parameters/variable (m , n) , as taught by Pu, in an empirical formulation similar to he claimed formulation with reasonable expectation of success

4. Claims 3, 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Johnson et al (US 2003/0006019) and Okumura et al (US 5,888,413) and Pu et al (2003/0192644) and further in view of Rudolph (US 6,162,298)

Johnson as modified by Okumura and Pu has been described above. Unlike the claimed invention as per claims 3, 6, Johnson, Okumura and Pu fails to disclose that

Art Unit: 1792

the first plasma source coil has a coil bushing whose upper surface is flat, the second plasma source coil has a coil bushing whose upper surface is concave, and the third plasma source coil has a coil bushing whose upper surface is convex, the coil bushing comprises a lower bushing part and an upper bushing part, the lower bushing part being made of a material different from that of the upper bushing part.

Rudolph discloses a CVD furnace comprises a coil bushing 106 source coil has flat upper surface and a concave/convex center portion, the coil bushing comprises a lower bushing part and an upper bushing part, the lower bushing part being made of a material different from that of the upper bushing part (col 6, lines 2-25, fig. 4)

One skilled in the art at the time the invention was made would have found it obvious to modify Johnson, Okumura and Pu method by employing a first plasma source coil having a coil bushing whose upper surface is flat, the second plasma source coil having a coil bushing whose upper surface is concave, and the third plasma source coil having a coil bushing whose upper surface is convex in view of Rudolph teaching in order to achieve uniform azimuthal space between the coils thus providing the uniformity of the plasma. One skilled in the art at the time the invention was made would also have found it obvious to modify Johnson, Okumura and Pu method by employing the coil bushing comprises a lower bushing part and an upper bushing part, the lower bushing part being made of a material different from that of the upper bushing part as per Rudolph to inhibit heat transfer in the chamber

Art Unit: 1792

5. Claims 9-11,12-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Johnson et al (US 2003/0006019) in view of Haranda et al (US 5,660,671)

Johnson discloses a process for plasma etching and depositing in a plasma chamber.

The process comprises:

mounting a wafer in a plasma chamber of a plasma chamber apparatus (fig.1)

the plasma chamber apparatus comprising

a plasma chamber 2, in which a wafer is mounted,

a bias power part for applying bias power to the rear surface of the wafer (para 0012)

a plasma source coil (3 unit coils (fig. 1)), the coil having single turn (para 0032) disposed on the plasma chamber for converting reaction gas introduced into the plasma chamber into plasma, the plasma source coil comprising a coil bushing and a plurality of unit coils helically wound on the coil bushing while one end of each of the unit coils is fixed to the coil bushing (para 0019, 0021)

a source power part for applying source power to the plasma source coil to generate plasma (para 0022)

supplying reaction gas into the plasma chamber while the source power is applied to selectively etch the surface of the wafer (para 0014, 0040)

Unlike the instant claimed inventions as per claims 9, 11, 13, Johnson fails to disclose applying source power of approximately 300 to 450 W/not more than 500 W and chlorine and BCl₃

Art Unit: 1792

Haranda discloses a plasma processing method comprises the steps of applying source power of 400 W/not more than 500 W and supplying chlorine and BCl₃ gases (col 11, lines 25-27, col 14, lines 60-62)

One skilled in the art at the time the invention was made would have found it obvious to modify Johnson method by applying source power of 400 W as per Haranda in order to eliminate the constriction on the sidewall of the etch structure without overetching the structure. One skilled in the art at the time the invention was made would also have found it obvious to modify Johnson method by supplying chlorine and BCl₃ gases as etching gases to achieve anisotropic etching effect free from undercut symptom as taught by Haranda (col 14, lines 58-65)

Unlike the instant claimed invention as per claim 12, Johnson fails to disclose the claimed range of the ratio of the source power to the bias power. However, since Johnson discloses that the RF power/source power may be adjusted/varied (para 0040), ones skilled in the art at the time the invention was made would have found it obvious to modify Johnson method by adjusting the source power/ the ratio of the source power to the bias power through routine experimentation to achieve the claimed range because Johnson discloses that the RF power may be adjusted to optimize the plasma chemistry (para 0040)

Allowable Subject Matter

6. Claims 14-23 allowed.

The following is an examiner's statement of reasons for allowance: Regarding claim 14, the cited prior art of record fails to disclose or suggest a method for manufacturing a plasma source coil comprises a step of inserting copper wires for the unit coils into the depressions of the shaping jig while applying heat to the copper wires for the unit coils to form helical copper wires having shapes similar to those of the unit coils, in combination with the rest of the steps of claim 14

Claims 4-5 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

. The following is a statement of reasons for the indication of allowable subject matter: Regarding claim 4, the cited prior art of record fails to disclose or suggest a method for manufacturing a plasma source coil comprises a limitation of the spacing between the unit coils of the third plasma source coil is gradually decreased as the radial distance from the center of the third plasma source coil is increased, in combination with the rest of the limitations of claim 4. Regarding claim 5, the cited prior art of record fails to disclose or suggest a method for manufacturing a plasma source coil comprises a limitation of the sectional area of each of the unit coils of the third plasma source coil is gradually decreased as the radial distance from the center of the third plasma source coil is increased, in combination with the rest of the limitations of claim 5.

Conclusion

Art Unit: 1792

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to LAN VINH whose telephone number is (571)272-1471.

The examiner can normally be reached on M-F 8:30-5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571 272 1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Lan Vinh/
Primary Examiner, Art Unit 1792